

8. REGULATIONS AND ADVISORIES

The international, national, and state regulations and guidelines regarding stable iodine in air, water, and other media are summarized in Table 8-1. The regulations regarding radioactive iodine are summarized in Tables 8-2 and 8-3.

No MRLs were derived for inhalation exposure to stable or radioactive iodine. Oral MRLs of 0.01 mg/kg/day were derived for both acute- and chronic-duration exposures. No oral MRL was derived for intermediate-duration exposure.

The EPA has not classified iodine for human carcinogenicity, nor has the EPA derived reference concentrations (RfCs) or reference doses (RfDs) for stable or radioactive iodine (IRIS 2000).

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Table 8-1. Regulations and Guidelines Applicable to Stable Iodine

Agency	Description	Information	References
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification	No data	
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	STEL (ceiling)	0.1 ppm	ACGIH 2000
NIOSH	REL (ceiling)	0.1 ppm	NIOSH 2001
	IDLH	2.0 ppm	
OSHA	PEL (ceiling)—general industry	0.1 ppm	OSHA 2001b 29CFR1910.1000
	PEL (ceiling)—construction industry	0.1 ppm	OSHA 2001a 29CFR1926.55
	PEL (ceiling)—shipyard industry	0.1 ppm	OSHA 2001c 29CFR1915.1000
b. Water			
EPA	Effluent limitation guidelines; inorganic chemicals manufacturing point source category for iodine production	Effluent reduction attainable by the application of BPT; no discharge of process wastewater pollutants to navigable waters	EPA 2001b 40CFR415.432
c. Food			
FDA	Drug products containing certain active ingredients offered over-the-counter for certain uses	Digestive aid and weight control drug product	FDA 2000a 21CFR310.545
	Drugs; recommended warning and caution statements—iodine and iodides (oral)	If a skin rash appears, discontinue use and consult physician	FDA 2000b 21CFR369.20
	Food additives permitted for direct addition to food for human consumption (as potassium iodide)		FDA 2000c 21CFR172.375
	Total amount for foods labeled without reference to age or physiological state	225 µg	
	Food additives permitted for direct addition to food for human consumption (as potassium iodide)		FDA 2000c 21CFR172.375
	Infants	45 µg	
	Children under 4 years of age	105 µg	
Adults and children 4 or more years of age	225 µg		
Pregnant or lactating women	300 µg		
Food labeling—RDI	150 µg		FDA 2001b 21CFR101.9

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Table 8-1. Regulations and Guidelines Applicable to Stable Iodine

Agency	Description	Information	References
<u>NATIONAL</u> (cont.)			
FDA	Indirect food additives; sanitizing solutions	Aqueous solution used on food and dairy processing equipment and utensils	FDA 2000d 21CFR178.1010 (b)(40)
	Nutrients—minimum amount per 100 kilocalories	5.0 µg	FDA 2001a
	Nutrition labeling of dietary supplements		FDA 2000e 21CFR101.36
	Nutritional quality guidelines RDI ^a	150 µg	FDA 2000f 21CFR104.20
	Amount per 100 calories ^b	7.5 µg	(d)(3)
	Trace minerals added to animal feeds—calcium iodate, calcium iodobenenate, cuprous iodide, 3,5-diiodosalicylic acid, ethylenediamine dihydroiodide, potassium iodate, potassium iodide, sodium iodate, sodium iodide, and thymol iodide	Recognized as safe when added at levels consistent with good feeding practice	FDA 2000i 21CFR582.80
d. Other			
ATF	List of denaturants authorized for denatured spirits		ATF 2001a 27CFR21.151
	List of products and processes using specially denatured alcohol and rum, and authorized formula		ATF 2001b 27CFR21.141
USC	List II chemical—regulated by the Attorney General as a chemical used in manufacturing a controlled substance		USC 2001 21USC802
<u>STATE</u>			
Regulations and Guidelines:			
a. Air			
Alaska	PEL (ceiling)	0.1 ppm	BNA 2001h
California	Airborne contaminant HAP		BNA 2001h BNA 2001h
Hawaii	Air contaminant		BNA 2001h
Idaho	Toxic air pollutants OEL EL AAC (24-hour average)	0.1 mg/m ³ 6.7x10 ⁻³ pounds/hour 5x10 ⁻³ mg/m ³	BNA 2001h
Michigan	Occupational air contaminant; maximum allowable concentrations Limits for air contaminants PEL (ceiling)	0.1 ppm 0.1 ppm	BNA 2001h BNA 2001h

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Agency	Description	Information	References
<u>STATE</u> (cont.)			
Montana	Occupational air contaminant TLV	0.1 ppm	BNA 2001h
New Hampshire	Regulated toxic air pollutant OEL	1 mg/m ³	BNA 2001h
New Mexico	Toxic air pollutant and emissions OEL Emissions	0.1 ppm 6.67x10 ⁻² pounds/hour	BNA 2001h
New York	Exposure limits PEL (ceiling)	0.1 ppm	BNA 2001h
Oregon	Air contaminant PEL (8-hour TWA)	0.1 ppm	BNA 2001h
Texas	Airborne contaminant		BNA 2001h
Vermont	Hazardous air contaminant Hazardous air contaminants that cause short-term irritant effects		BNA 2001h BNA 2001h
	Annual average Averaging time Action level	100 µg/m ³ 8 hours 4.2 pounds/8 hours	
Washington	Toxic air pollutant and acceptable source impact levels	3.3 µg/m ³ per 24-hour average	BNA 2001h
b. Water			
Maine	Drinking water guideline—iodide ion	340 µg/L	HSDB 2001
Rhode Island	Water resources—toxic pollutant		BNA 2001h
c. Food		No data	
d. Other			
California	Hazardous substance list		BNA 2001h
Florida	Toxic substance in the workplace		BNA 2001h
Massachusetts	Oil and hazardous material list		BNA 2001h
Pennsylvania	Worker and Community Right-to- Know Act—hazardous substance list		BNA 2001h

^aRDI for adults and children 4 or more years of age

^b100 calories, based on 2,000 calorie intake as a daily standard

AAC = acceptable ambient concentrations; ACGIH = American Conference of Governmental Industrial Hygienists; ATF = Alcohol, Tobacco, and Firearms; BPT = best practicable control technology; BNA = Bureau of National Affairs; CFR = Code of Federal Regulations; EL = emissions level; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; HAP = hazardous air pollutant; HSDB = Hazardous Substances Data Bank; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life and health; NIOSH = National Institute of Occupational Safety and Health; OEL = occupational exposure limit; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; RDI = recommended daily intake; REL = relative exposure limit; STEL = short term exposure limit; TLV = threshold limit value; TWA = time weighted average; USC = United States Code

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information	References
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification	No data	
ICRP	Occupational recommended dose limits ^a ; effective dose	20 mSv per year, averaged over defined period of 5 years ^b	ICRP 1991
	Annual equivalent dose		
	Lens of the eye	150 mSv	
	Skin ^c	500 mSv	
	Hands and feet	500 mSv	
	General population recommended dose limits ^a		ICRP 1991
	Effective dose	1.0 mSv per year ^d	
	Annual equivalent dose		
	Lens of the eye	15 mSv	
	Skin ^c	50 mSv	
	Hands and feet	No data	
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	Effective dose		ACGIH 2000
	Any single year	50 mSv	
	Averaged over 5 years	20 mSv	
	Annual equivalent dose to		
	Lens of the eye	150 mSv	
	Skin	500 mSv	
	Hands and feet	500 mSv	
	Embryo-fetus exposures once the pregnancy is known		
	Monthly equivalent dose	0.5 mSv	
	Dose to the surface of women's abdomen (lower trunk)	2 mSv for the remainder of the pregnancy	
	Intake of radionuclide	1/20 ALI	
NIOSH	REL	No data	
USNRC	Occupational values—inhalation	<u>ALI (μCi)</u>	<u>DAC^e (μCi/mL)</u>
	¹²⁰ I	1x10 ⁴	4x10 ⁻⁵
	^{120m} I	2x10 ⁴	9x10 ⁻⁶
	¹²¹ I	5x10 ⁴	8x10 ⁻⁶
	¹²³ I	6x10 ³	3x10 ⁻⁶
	¹²⁴ I	3x10 ²	3x10 ⁻⁸
	¹²⁵ I	2x10 ²	3x10 ⁻⁸
	¹²⁶ I	1x10 ²	1x10 ⁻⁸
	¹²⁸ I	1x10 ⁵	5x10 ⁻⁵
			USNRC 2001a 10CFR20, Appendix B

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information		References		
NATIONAL (cont.)						
USNRC (cont.)	Occupational values— <i>inhalation</i>	<u>ALI (μCi)</u>	<u>DAC^e (μCi/mL)</u>	USNRC 2001a 10CFR20, Appendix B		
	¹²⁹ I	3x10 ¹	4x10 ⁻⁹			
	¹³⁰ I	2x10 ³	3x10 ⁻⁷			
	¹³¹ I	2x10 ²	2x10 ⁻⁸			
	¹³² I	1x10 ⁴	3x10 ⁻⁶			
	^{132m} I	2x10 ⁴	4x10 ⁻⁶			
	¹³³ I	9x10 ²	1x10 ⁻⁷			
	¹³⁴ I	5x10 ⁴	2x10 ⁻⁵			
	¹³⁵ I	4x10 ³	7x10 ⁻⁷			
	Effluent concentrations (μCi/mL)				USNRC 2001a 10CFR20, Appendix B	
	¹²⁰ I	2x10 ⁻⁸				
	^{120m} I	3x10 ⁻⁸				
	¹²¹ I	7x10 ⁻⁸				
	¹²⁴ I	4x10 ⁻¹⁰				
	¹²⁵ I	3x10 ⁻¹⁰				
	¹²⁶ I	2x10 ⁻¹⁰				
	¹²⁸ I	2x10 ⁻⁷				
	¹²⁹ I	4x10 ⁻¹¹				
	¹³⁰ I	3x10 ⁻⁹				
	¹³¹ I	2x10 ⁻¹⁰				
	¹³² I	2x10 ⁻⁸				
	^{132m} I	3x10 ⁻⁸				
	¹³³ I	1x10 ⁻⁹				
	¹³⁴ I	6x10 ⁻⁸				
	¹³⁵ I	6x10 ⁻⁹				
	OSHA	PEL (8-hour TWA)	No data			
	b. Water					
USNRC	Effluent concentrations (μCi/mL)			USNRC 2001a 10CFR20, Appendix B		
	¹²⁰ I	1x10 ⁻⁴				
	^{120m} I	2x10 ⁻⁴				
	¹²¹ I	4x10 ⁻⁴				
	¹²⁴ I	2x10 ⁻⁶				
	¹²⁵ I	2x10 ⁻⁶				
	¹²⁶ I	1x10 ⁻⁶				
	¹²⁸ I	8x10 ⁻⁴				
	¹²⁹ I	2x10 ⁻⁷				
	¹³⁰ I	2x10 ⁻⁵				
	¹³¹ I	1x10 ⁻⁶				
	¹³² I	1x10 ⁻⁴				
	^{132m} I	1x10 ⁻⁴				
	¹³³ I	7x10 ⁻⁶				
	¹³⁴ I	4x10 ⁻⁴				
	¹³⁵ I	3x10 ⁻⁵				
	Releases to sewers; monthly average concentration (μCi/mL)				USNRC 2001a 10CFR20, Appendix B	
	¹²⁰ I	1x10 ⁻³				
	^{120m} I	2x10 ⁻³				
	¹²¹ I	4x10 ⁻³				
	¹²⁴ I	2x10 ⁻⁵				

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information	References
NATIONAL (cont.)			
USNRC (cont.)	Releases to sewers; monthly average concentration ($\mu\text{Ci/mL}$)		USNRC 2001a 10CFR20, Appendix B
	¹²⁵ I	2×10^{-5}	
	¹²⁶ I	1×10^{-5}	
	¹²⁸ I	8×10^{-3}	
	¹²⁹ I	2×10^{-6}	
	¹³⁰ I	2×10^{-4}	
	¹³¹ I	1×10^{-5}	
	¹³² I	1×10^{-3}	
	^{132m} I	1×10^{-3}	
	¹³³ I	7×10^{-5}	
	¹³⁴ I	4×10^{-3}	
	¹³⁵ I	3×10^{-4}	
c. Food			
FDA	Derived intervention level ^f (DIL; Bq/kg food) for ¹³¹ I in accidentally-contaminated human food	167	FDA 1998
	Sources of radiation used for food inspection; sealed units producing radiation (¹²⁵ I)	Not more than 2.2 million electron volts	FDA 2000h 21CFR179.21
	Requirements regarding certain radioactive drugs (¹³¹ I)	Diagnosis of thyroid functions; thyroid scans; treatment of hyper-thyroidism and/or cardiac dysfunction; treatment of thyroid carcinoma	FDA 2000g 21CFR310.503
d. Other			
DOE	Radiation standards; DAC ^g for controlling radiation exposure to workers at DOE facilities ^h ($\mu\text{Ci/mL}$)		DOE 2001b 10CFR835, Appendix A
	^{120m} I	9×10^{-6}	
	¹²⁰ I	4×10^{-6}	
	¹²¹ I	7×10^{-6}	
	¹²³ I	3×10^{-6}	
	¹²⁴ I	3×10^{-8}	
	¹²⁵ I	3×10^{-8}	
	¹²⁶ I	1×10^{-8}	
	¹²⁸ I	5×10^{-5}	
	¹²⁹ I	4×10^{-9}	
	¹³⁰ I	3×10^{-7}	
	¹³¹ I	2×10^{-8}	
	^{132m} I	4×10^{-6}	
	¹³² I	3×10^{-6}	
	¹³³ I	1×10^{-7}	
	¹³⁴ I	2×10^{-5}	
	¹³⁵ I	7×10^{-7}	

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information		References
<u>NATIONAL</u> (cont.)				
DOE	Radiation standards; DAC ⁹ for workers from external exposure during immersion in contaminated atmospheric cloud (Ci/mL)			DOE 2001a 10CFR835, Appendix C
	¹²² I	5x10 ⁻⁶		
	¹²⁸ I	5x10 ⁻⁵		
	¹³² I	2x10 ⁻⁶		
	¹³⁴ I	1x10 ⁻⁶		
	¹³⁵ I	7x10 ⁻⁷		
	¹³⁶ I	1x10 ⁻⁶		
	Values for establishing sealed radioactive source accountability and radioactive material posting and labeling requirements			DOE 2001c 10CFR835, Appendix E
	¹²⁵ I	3.5x10 ²		
	¹²⁹ I	1.8x10 ²		
DOT	General requirements for shipments and packagings; A1 and A2 values for radionuclides			DOT 2001a 49CFR173.435
		<u>A1 (Ci)</u>	<u>A2 (Ci)</u>	
	¹²³ I	6	162	
	¹²⁴ I	0.9	24.3	
	¹²⁵ I	2	54.1	
	¹²⁶ I	0.9	24.3	
	¹²⁹ I	Unlimited	Unlimited	
	¹³¹ I	0.5	13.5	
	¹³² I	0.4	10.8	
	¹³³ I	0.5	13.5	
	¹³⁴ I	0.3	8.11	
	¹³⁵ I	0.3	13.5	
	Hazardous substance and reportable quantity (Ci)			DOT 2001b 49CFR171.101, Appendix A
	¹²⁰ I	10		
	^{120m} I	100		
	¹²¹ I	100		
	¹²³ I	10		
	¹²⁴ I	0.1		
	¹²⁵ I	0.01		
	¹²⁶ I	0.01		
	¹²⁸ I	1,000		
	¹²⁹ I	0.001		
	¹³⁰ I	1.0		
	¹³¹ I	0.01		
	¹³² I	10		
	^{132m} I	10		
	¹³³ I	0.1		
	¹³⁴ I	100		
	¹³⁵ I	10		

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information			References	
<u>NATIONAL (cont.)</u>						
EPA	Annual possession quantities for environmental compliance (Ci/year)	<u>Gas</u>	<u>Liquid/Solid</u>	<u>Powder</u>	EPA 2001a 40CFR61, Appendix E	
		¹²³ I	4.9x10 ⁻¹	4.9x10 ⁻⁵		4.9x10 ²
		¹²⁴ I	9.3x10 ⁻³	9.3x10 ³		9.3x10 ⁰
		¹²⁵ I	6.2x10 ⁻³	6.2x10 ³		6.2x10 ⁰
		¹²⁶ I	3.7x10 ⁻³	3.7x10 ³		3.7x10 ⁰
		¹²⁸ I	9.3x10 ⁰	9.3x10 ⁶		9.3x10 ³
		¹²⁹ I	2.6x10 ⁻⁴	2.6x10 ²		2.6x10 ⁻¹
		¹³⁰ I	4.6x10 ⁻²	4.6x10 ⁴		4.6x10 ¹
		¹³¹ I	6.7x10 ⁻³	6.7x10 ³		6.7x10 ⁰
		¹³² I	2.0x10 ⁻¹	2.0x10 ⁵		2.0x10 ²
		¹³³ I	6.7x10 ⁻²	6.7x10 ⁴		6.7x10 ¹
		¹³⁴ I	3.2x10 ⁻¹	3.2x10 ⁵		3.2x10 ²
		¹³⁵ I	1.2x10 ⁻¹	1.2x10 ⁵		1.2x10 ²
		Release limits for containment ⁱ				
	¹²⁹ I	100 Ci				
	Reportable quantity (Ci)				BNA 2001f 40CFR302.4, Appendix B	
	^{120m} I	100				
	¹²⁰ I	10				
	¹²¹ I	100				
	¹²³ I	10				
	¹²⁴ I	0.1				
	¹²⁵ I	0.01				
	¹²⁶ I	0.01				
	¹²⁸ I	1,000				
	¹²⁹ I	0.001				
	¹³⁰ I	1.0				
	¹³¹ I	0.01				
	^{132m} I	10				
	¹³² I	10				
	¹³³ I	0.1				
	¹³⁴ I	100				
	¹³⁵ I	10				
	Carcinogenicity slope factors ^j				EPA 2002b	
	Ingestion—lifetime excess total cancer risk/pCi					
	Water					
¹²² I	No data					
¹²³ I	6.96x10 ⁻¹³					
¹²⁵ I	2.54x10 ⁻¹¹					
¹²⁶ I	8.73x10 ⁻¹¹					
¹²⁹ I	1.48x10 ⁻¹⁰					
¹³⁰ I	6.36x10 ⁻¹²					
¹³¹ I	4.55x10 ⁻¹¹					
¹³² I	8.44x10 ⁻¹³					
¹³³ I	1.44x10 ⁻¹¹					
¹³⁴ I	2.50x10 ⁻¹³					
¹³⁵ I	3.05x10 ⁻¹²					

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Agency	Description	Information	References
NATIONAL (cont.)			
EPA (cont.)	Ingestion—lifetime excess total cancer risk/pCi		EPA 2002b
	Food		
	122 _I	No data	
	123 _I	2.05x10 ⁻¹²	
	125 _I	6.29x10 ⁻¹¹	
	126 _I	2.48x10 ⁻¹⁰	
	129 _I	3.22x10 ⁻¹⁰	
	130 _I	1.88x10 ⁻¹¹	
	131 _I	1.34x10 ⁻¹⁰	
	132 _I	2.34x10 ⁻¹²	
	133 _I	4.40x10 ⁻¹¹	
	134 _I	6.44x10 ⁻¹³	
	135 _I	8.99x10 ⁻¹²	
	Ingestion—lifetime excess total cancer risk/pCi		
	Soil		
	122 _I	No data	
	123 _I	1.96x10 ⁻¹²	
	125 _I	5.55x10 ⁻¹¹	
	126 _I	2.31x10 ⁻¹⁰	
	129 _I	2.71x10 ⁻¹⁰	
	130 _I	1.80x10 ⁻¹¹	
	131 _I	1.26x10 ⁻¹⁰	
	132 _I	2.22x10 ⁻¹²	
	133 _I	4.26x10 ⁻¹¹	
	134 _I	5.96x10 ⁻¹³	
	135 _I	8.62x10 ⁻¹²	
	Inhalation ^k —lifetime excess total cancer risk/pCi		
	122 _I	No data	
	123 _I	3.03x10 ⁻¹³	
	125 _I	1.06x10 ⁻¹¹	
	126 _I	3.70x10 ⁻¹¹	
	129 _I	6.07x10 ⁻¹¹	
	130 _I	2.76x10 ⁻¹²	
	131 _I	1.95x10 ⁻¹¹	
	132 _I	3.74x10 ⁻¹³	
	133 _I	6.25x10 ⁻¹²	
	134 _I	1.02x10 ⁻¹³	
	135 _I	1.34x10 ⁻¹²	
	External exposure ^l —risk/year per pCi/g in soil		
	122 _I	4.17x10 ⁻⁶	
	123 _I	5.10x10 ⁻⁷	
	125 _I	7.24x10 ⁻⁹	
	126 _I	1.96x10 ⁻⁶	
	129 _I	6.10x10 ⁻⁹	
	130 _I	9.67x10 ⁻⁶	

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Agency	Description	Information	References
NATIONAL (cont.)			
EPA (cont.)	External exposure ^l —risk/year per pCi/g in soil		EPA 2002b
	¹³¹ I	1.59x10 ⁻⁶	
	¹³² I	1.06x10 ⁻⁵	
	¹³³ I	2.72x10 ⁻⁶	
	¹³⁴ I	1.24x10 ⁻⁵	
	¹³⁵ I	7.83x10 ⁻⁶	
NCRP	Occupational exposures ^m		NCRP 1993
	Effective dose limits		
	Annual	50 mSv	
	Cumulative	10 mSv x age	
	Equivalent dose annual limits for tissues and organs		
	Lens of eye	150 mSv	
	Skin, hands, and feet	500 mSv	
	Public exposures (annual)		
	Effective dose limit, continuous or frequent exposure ^m	1.0 mSv	
	Effective dose limit, infrequent exposure ^m	5 mSv	
	Equivalent dose limits for tissues and organs ^m		
	Lens of eye	15 mSv	
	Skin, hands, and feet	50 mSv	
USNRC	ALI (μCi)—oral ingestion		USNRC 2001a 10CFR20, Appendix B
	¹²⁰ I	8x10 ³	
	^{120m} I	1x10 ⁴	
	¹²¹ I	3x10 ⁴	
	¹²³ I	3x10 ³	
	¹²⁴ I	2x10 ²	
	¹²⁵ I	1x10 ²	
	¹²⁶ I	7x10 ¹	
	¹²⁸ I	6x10 ⁴	
	¹²⁹ I	2x10 ¹	
	¹³⁰ I	1x10 ³	
	¹³¹ I	9x10 ¹	
	¹³² I	9x10 ³	
	^{132m} I	1x10 ⁴	
	¹³³ I	5x10 ²	
	¹³⁴ I	3x10 ⁴	
	¹³⁵ I	3x10 ³	
	Byproduct material listing (Ci)	Column I ⁿ	Column II ^o
	¹²⁵ I	0.1	0.00
	¹²⁶ I	0.1	0.001
	¹²⁹ I	0.1	0.01
	¹³¹ I	0.1	0.001
	¹³² I	10	0.1
	¹³³ I	1.0	0.01
	¹³⁴ I	10	0.1
	¹³⁵ I	1.0	0.01

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information			References			
<u>NATIONAL</u> (cont.)								
USNRC	Individual monitoring ¹³¹ I	1.0 Ci			BNA 2001a 10CFR20.2206			
	Laboratory testing and use ¹²⁵ I and ¹³¹ I	≤10 μCi			BNA 2001b 10CFR32.71			
	Packaging and transportation of radioactive material; determination of A1 and A2 ¹²³ I ¹²⁴ I ¹²⁵ I ¹²⁶ I ¹²⁹ I ¹³¹ I ¹³² I ¹³³ I ¹³⁴ I ¹³⁵ I		<u>A1 (Ci)</u>	<u>A2 (Ci)</u>	<u>Specific Activity</u>	USNRC 2001c 10CFR71, Appendix A		
			6.0	162	1.9x10 ⁶			
			0.9	24.3	2.5x10 ⁵			
			2.0	54.1	1.7x10 ⁴			
			0.9	24.3	8.0x10 ⁴			
			Unlimited	Unlimited	1.8x10 ⁴			
			0.5	13.5	1.2x10 ⁵			
			0.4	10.8	1.0x10 ⁷			
			0.5	13.5	1.1x10 ⁶			
			0.3	8.11	2.7x10 ⁷			
			0.5	13.5	3.5x10 ⁶			
			Quantities requiring consideration of the need for an emergency plan; ¹²⁵ I and ¹³¹ I				BNA 2001c 10CFR30.72, Schedule C	
			Release fraction					
		Quantity	0.5% 10 Ci					
		Standards for protection against radiation; quantities of licensed material requiring labeling (μCi)				BNA 2001d 10CFR20, Appendix C		
		^{120m} I	1,000					
		¹²⁰ I	100					
		¹²¹ I	1,000					
	¹²³ I	100						
	¹²⁴ I	10						
	¹²⁵ I	1.0						
	¹²⁶ I	1.0						
	¹²⁸ I	1,000						
	¹²⁹ I	1.0						
	¹³⁰ I	10						
	¹³¹ I	1.0						
	^{132m} I	100						
	¹³² I	100						
	¹³³ I	10						
	¹³⁴ I	1,000						
	¹³⁵ I	100						
	Waste classification				USNRC 2001d 10CFR61.55			
	Concentration of ¹²⁹ I	0.08 Ci/m ³						
<u>STATE</u>								
Regulations and Guidelines:								
a. Air		No data						
b. Water								
Kentucky	Maximum groundwater contaminant level ¹³¹ I	3 pCi/L			BNA 2001h			
c. Food		No data						

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Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information		References
d. Other				
Arkansas	Licensing of radioactive materials; exempt concentrations (Ci/mL, solids are Ci/g)	<u>Column 1ⁿ</u>	<u>Column 2^o</u>	BNA 2001h
	¹²⁶ I	3x10 ⁻⁹	6x10 ⁻⁴	
	¹³¹ I	2x10 ⁻⁵	1x10 ⁻⁸	
	¹³² I	3x10 ⁻⁹	7x10 ⁻⁵	
	¹³³ I	2x10 ⁻⁵	2x10 ⁻⁷	
	¹³⁴ I	8x10 ⁻⁸	1x10 ⁻³	
California	Licensing of radioactive materials; Schedule C (μCi/mL)	<u>Column 1ⁿ</u>	<u>Column 2^o</u>	BNA 2001h
	¹²⁶ I	3x10 ⁻⁹	2x10 ⁻⁵	
	¹³¹ I	3x10 ⁻⁹	2x10 ⁻³	
	¹³² I	8x10 ⁻⁸	6x10 ⁻⁴	
	¹³³ I	1x10 ⁻⁸	7x10 ⁻³	
	¹³⁴ I	2x10 ⁻⁷	1x10 ⁻³	
Florida	Quantities requiring consideration of the need for an emergency plan; ¹²⁵ I and ¹³¹ I Release fraction Quantity	0.5% 10 Ci		BNA 2001h
Indiana	Licensing of radioactive materials; Schedule A; exempt concentrations (μCi/mL)	<u>Column 1ⁿ</u>	<u>Column 2^o</u>	BNA 2001h
	¹²⁶ I	3x10 ⁻⁹	2x10 ⁻⁵	
	¹³¹ I	3x10 ⁻⁹	2x10 ⁻³	
	¹³² I	8x10 ⁻⁸	6x10 ⁻⁴	
	¹³³ I	1x10 ⁻⁸	7x10 ⁻³	
	¹³⁴ I	2x10 ⁻⁷	1x10 ⁻³	
Kansas	Licensing of sources of radiation; Schedule B; exempt quantities of radioactive material (μCi)			BNA 2001h
	¹²³ I	100		
	¹²⁵ I	1.0		
	¹²⁶ I	1.0		
	¹²⁹ I	0.1		
	¹³¹ I	1.0		
	¹³² I	10		
	¹³³ I	1.0		
	¹³⁴ I	10		
	¹³⁵ I	10		
Louisiana	Standards for protection against radiation			BNA 2001h
	^{120m} I	100		
	¹²⁰ I	10		
	¹²¹ I	100		

8. REGULATIONS AND ADVISORIES

Table 8-2. Regulations and Guidelines Applicable to Radioactive Iodine

Agency	Description	Information	References
<i>STATE (cont.)</i>			
Louisiana (cont.)	Standards for protection against radiation		BNA 2001h
	¹²³ I _l	10	
	¹²⁴ I _l	0.1	
	¹²⁵ I _l	0.01	
	¹²⁶ I _l	0.01	
	¹²⁸ I _l	1,000	
	¹²⁹ I _l	0.001	
	¹³⁰ I _l	1.0	
	¹³¹ I _l	0.01	
	^{132m} I _l	10	
	¹³² I _l	10	

^aThe limits apply to the sum of the relevant doses from external exposure in the specified period and the 50-year committed dose (to age 70 years for children) from intakes in the same period.

^bWith the further provision that the effective dose should not exceed 50 mSv in any single year. Additional restrictions apply to the occupational exposure of pregnant women.

^cThe limitation on the effective dose provides sufficient protection for the skin against stochastic effects. An additional limit is needed for localized exposures in order to prevent deterministic effects.

^dIn special circumstances, a higher value of effective dose could be allowed in a single year, provided that the average over 5 years does not exceed 1.0 mSv per year.

^eDAC is the concentration of radioactive material in air and the time of exposure to that radionuclide, in hours. An NRC licensee may take 2,000 hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 sievert).

^fThe FDA-recommended Derived Intervention Level (DIL) for radionuclides of ¹³¹I, is defined as the DIL for the most sensitive age group (1 year) that was calculated from the most limiting Protective Action Goal (PAG; 50 mSv committed dose equivalent to the thyroid).

^gDAC for the radionuclides listed in Appendix A of 10CFR835, the airborne concentration that equals ALI divided by the volume of air breathed by an average worker for a working year of 2,000 hours (assuming a breathing volume of 2,400 m³). For the radionuclides listed in Appendix C of 10CFR835, the air immersion DACs were calculated for a continuous, non-shielded exposure via immersion in a semi-infinite atmospheric cloud.

^hClass D: approximate length of retention in the pulmonary region is less than 10 days.

ⁱRelease limit per 1,000 metric tons of heavy metal or other unit of waste.

^jRadioactive slope factors calculated by EPA's Office of Radiation and Indoor Air (ORIA). Slope factors are central estimates in a linear model of the age-averaged, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unit of activity ingested, expressed as risk per picocurie (pCi).

^kInhalation slope factors are central estimates in a linear model of the age-average, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled, expressed as risk per picocurie (pCi).

^lExternal slope factors are central estimates of the lifetime attributable radiation cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, expressed as risk/year per pCi per gram of soil.

^mSum of external and internal exposures but excluding doses from natural sources.

ⁿColumn 1: gas concentration

^oColumn 2: liquid and solid concentration

ACGIH = American Conference of Governmental Industrial Hygienists; ALI = annual limits on intake; BNA = Bureau of National Affairs; CFR = Code of Federal Regulations; DAC = derived air concentrations; DOE = Department of Energy; DOT = Department of Transportation; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; ICRP = International Commission on Radiological Protection; mSv = millisievert; NIOSH = National Institute of Occupational Safety and Health; NCRP = National Council on Radiation Protection; USNRC = U.S. Nuclear Regulatory Commission; OSHA = Occupational Safety and Health Administration; PAG = protective action guide; PEL = permissible exposure limit; REL = relative exposure limit; TLV = threshold limit value; TWA = time-weighted average

8. REGULATIONS AND ADVISORIES

Table 8-3. Dose Coefficients^a (e(50)) for Intakes of Iodine Radionuclides

Radionuclide	Half-life	f ₁ ^c	Inhalation, 1µm AMAD ^b	Inhalation, 5µm AMAD	Ingestion
			e(50)	e(50)	e(50)
¹²⁰ I	1.35/hour	1.0	1.0x10 ⁻¹⁰	1.9x10 ⁻¹⁰	3.4x10 ⁻¹⁰
^{120m} I	0.883/hour	1.0	8.7x10 ⁻¹¹	1.4x10 ⁻¹⁰	2.1x10 ⁻¹⁰
¹²¹ I	2.12/hour	1.0	2.8x10 ⁻¹¹	3.9x10 ⁻¹¹	8.2x10 ⁻¹¹
¹²³ I	13.2/hour	1.0	7.6x10 ⁻¹¹	1.1x10 ⁻¹⁰	2.1x10 ⁻¹⁰
¹²⁴ I	4.18/day	1.0	4.5x10 ⁻⁹	6.3x10 ⁻⁹	1.3x10 ⁻⁸
¹²⁵ I	60.1/day	1.0	5.3x10 ⁻⁹	7.3x10 ⁻⁹	1.5x10 ⁻⁸
¹²⁶ I	13.0/day	1.0	1.0x10 ⁻⁸	1.4x10 ⁻⁸	2.9x10 ⁻⁸
¹²⁸ I	0.416/hour	1.0	1.4x10 ⁻¹¹	2.2x10 ⁻¹¹	4.6x10 ⁻¹¹
¹²⁹ I	1.57x10 ⁷ /year	1.0	3.7x10 ⁻⁸	5.1x10 ⁻⁸	1.1x10 ⁻⁷
¹³⁰ I	12.4/hour	1.0	6.9x10 ⁻¹⁰	9.6x10 ⁻¹⁰	2.0x10 ⁻⁹
¹³¹ I	8.04/day	1.0	7.6x10 ⁻⁹	1.1x10 ⁻⁸	2.2x10 ⁻⁸
¹³² I	2.30/hour	1.0	9.6x10 ⁻¹¹	2.0x10 ⁻¹⁰	2.9x10 ⁻¹⁰
^{132m} I	1.39/hour	1.0	8.1x10 ⁻¹¹	1.1x10 ⁻¹⁰	2.2x10 ⁻¹⁰
¹³³ I	20.8/hour	1.0	1.5x10 ⁻⁹	2.1x10 ⁻⁹	4.3x10 ⁻⁹
¹³⁴ I	0.876/hour	1.0	4.8x10 ⁻¹¹	7.9x10 ⁻¹¹	1.1x10 ⁻¹⁰
¹³⁵ I	6.61/hour	1.0	3.3x10 ⁻¹⁰	4.6x10 ⁻¹⁰	9.3x10 ⁻¹⁰

^aICRP (1994a)^bICRP (1994a) calculated inhalation dose coefficients for particles with AMAD of 1 or 5 µm.^cFractional absorption factor used by ICRP (1994, Annexes E and F) to calculate effective dose coefficients.

ALI = annual limits on intake; AMAD = activity median average diameters; Ci = curies

